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*Indian Standard*

**CODE OF PRACTICE FOR  
IMPROVED THATCHING OF ROOF WITH  
ROT AND FIRE RETARDANT TREATMENT**

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**BUREAU OF INDIAN STANDARDS**  
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NEW DELHI 110002

## *Indian Standard*

# CODE OF PRACTICE FOR IMPROVED THATCHING OF ROOF WITH ROT AND FIRE RETARDANT TREATMENT

## 0. FOREWORD

**0.1** This Indian Standard was adopted by the Bureau of Indian Standards on 4 November 1988, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** Thatch roof is made of highly combustible and easily ignitable materials. In rural and slum area, majority of people live in huts. Fire occurs very often in huts. It spreads very fast and conflagration results engulfing the entire village causing loss of and injury to human lives and cattle and damage to property. The thatch is exposed to rain, sun and nature and thus deteriorates fast and lasts only for one to two years. The main thatch materials are reeds (Phoons), palmyrah, coconut, rice paddy, available in Northern, Southern, Eastern, and Western regions of the country. Fire risk and fire hazard is present throughout the rural and slum areas. Fire retardant treatment for render-

ing thatch fire retardant is a measure of fire protection and to reduce the fire hazard in rural and slum houses. The provisions of the standard are largely based on data furnished by the Central Building Research Institute, Roorkee.

**0.3** This code of practice has been prepared to satisfy the need for laying down specific requirement for various types of thatch roofs of different materials to make them fire retardant and durable.

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2 - 1960.\* The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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\*Rules for rounding off numerical values (*revised*).

## 1. SCOPE

**1.1** This code covers essentially the technology of making rot and fire retardant thatches for rural and slum areas.

## 2. TERMINOLOGY

**2.1 Cut-Back** — A mixture of bitumen and kerosene oil.

**2.2 Fire** — A process of combustion characterized by heat or smoke or flame or any combination of these.

**2.3 Fire Brand** — Glowing or flaming materials raised by strong convective currents and carried by high winds under some conditions.

**2.4 Fire Loss** — Material damage caused directly by fire expressed in monetary terms.

**2.5 Fire Growth** — The development of a fire from ignition to the point of maximum severity.

**2.6 Fire Hazard** — Start and spread of a fire which might endanger lives or property.

**2.7 Fire Prevention** — Covers precautionary activities aimed at stopping the outbreak of fire and reducing losses of life and property and reduction of fire hazards.

**2.8 Fire Protection** — The practice of reducing life and property loss by fire, fire control and

fire prevention, fire precautions, and fire retardant treatment.

**2.9 Fire Retardant** — A substance or treatment applied to the material to increase its resistance to destruction by fire.

**2.10 Fire Weather** — Fire weather includes consideration of temperature, humidity, and other factors.

**2.11 Flame Propagation** — A term relating to the spread of flame from layer to layer independently of the source of ignition.

**2.12 Flame Retardant** — A substance or treatment applied to a material to decrease its tendency to propagate flame across the surface.

**2.13 Flame Spread** — The propagation of flame over a surface.

**2.14 Flammable** — Capable of burning with a flame.

**2.15 Glowing Combustion** — Incandescent oxidation of a solid surface.

**2.16 Ignition** — A process initiating combustion.

**2.17 Incandescence** — Made luminous by heat or glowing with heat.

**2.18 Incombustible** — Non-combustible.

**2.19 Self-Extinguishing** — Incapable of undergoing sustained combustion after the removal of external source of heat.

**2.20 Smouldering** — A process of combustion without flame but usually with incandescence.

### 3. DESCRIPTION

**3.1** The thatch roof is generally mounted on mud wall keeping a slope of 30°. The bamboo frame is prepared by approximately 50 mm diameter sticks, placed across each other about 300 mm apart and tied with *SUTLI* or any other thin strong string, or nailed. Lay and fix the reeds (phoons)/palmyrah leaves/coconut/rice paddy on the frame as close as possible in such a way that a thickness of 100 ± 10 mm of the thatch may be obtained. The thatch is projected at least 300 to 450 mm outside the mud wall or supporting structure. The thatch is tied with the structure at different point to hold it firmly. To make that thatch fire retardant and water-repellent, the top and bottom surfaces are to be plastered with bitumen stabilized mud.

### 4. MATERIALS FOR FIRE RETARDANT TREATMENT OF THATCHES

**4.1 Bitumen** — Homogeneous bitumen of 80/100 grade shall be used.

**4.2 Cut-Back** — Molten bitumen (80/100) is mixed with kerosene oil in the proportion of 5 : 1. The mixture is stirred constantly till all the ingredients are mixed thoroughly and homogeneously. For 18 kg cut-back, mix 15 kg melted bitumen (hot) into a container having 3 litres kerosene oil with constant stirring till it mixes completely.

**4.3 Soil** — It shall have approximately 25 to 35 percent clay content (*KUCHHA* pond soil).

**4.4 Mud** — Mix 18 kg wheat straw or rice paddy (cut to 50 mm length approx) with every 0.28 cubic metre of soil and keep it wet for a week and knead daily. This ensures rotting of the *BHUSA*/paddy straw and increases its workability.

**4.5 Bitumen Stabilized Mud** — For 0.28 cubic metre of mud, add 18 kg (4 percent) cut-back and mix thoroughly by turning over the mud with spade and knead till a homogenous mixture is obtained.

NOTE — No black spots of unmixed cut-back are left in mud.

**4.6 GOBRI** — Cow dung and soil are mixed together in proportion of 1 : 1 with sufficient water to make a thin slurry. Bitumen cut-back is mixed at the rate of 64 kg per cubic metre.

**4.7 Water Proof Solution (1 : 2)** — One part of hot molten bitumen is added into 2 parts of kerosene oil and stirring continued till the homogenous solution is obtained.

**4.8 Lime Wash** — A lime wash dispersion made in water mixed with animal glue and ultramarine blue for whitening.

### 5. MATERIALS FOR ALL TYPES OF THATCHES

**5.1 Reed/Roof ( Phoons ) Thatch**

**5.2 Thatch Area** — 9.3 m<sup>2</sup>.

**5.3 Average Thickness** — 75 mm of thatch plus 25 mm mud plaster on top surface and 10 mm on the bottom surface.

**5.4 Reed ( Phoons )** — 130 bundles ( each bundle 500 g and one metre long ).

**5.5 Bamboo** — 20 numbers ( Dia of each 50 mm and 3.3 m long ).

**5.6 SUTLI** — One kg *MOONJ* of ( 1.5 kg ).

**5.7 Mud Bitumenized** — 0.34 cubic metre.

**5.8 Wheat Straw** — 23.4 kg.

**5.9 Bhind ( SARKANDA )** — 3 bundles ( each bundle about 400 mm thick and 300 mm long ).

### 6. PALMYRAH LEAVES THATCH

**6.1 Average Thickness** — 75 mm of thatch plus 25 mm bitumenized mud plaster on top surface and 10 mm on the bottom surface.

**6.2 Palmyrah Leaves** — 90 numbers.

**6.3 Bamboo** — 20 numbers ( 3.3 m and 50 mm dia ).

**6.4 SUTLI** — 1.5 kg.

**6.5 Mud Bitumenized** — 0.34 cubic metre.

**6.6 Wheat Straw** — 24 kg

### 7. COCONUT LEAVES THATCH

**7.1 Thatch Roof Area** — 9.3 m<sup>2</sup>.

**7.2 Average Thickness** — 25 mm of thatch plus 25 mm mud plaster on top surface and 10 mm on the bottom surface.

**7.3 Coconut Leaves ( Cadjan Leaves )** — 65 numbers.

**7.4 Bamboos** — 20 numbers ( 3.3 m long and 25 mm dia ).

**7.5 SUTLI** — 1 kg.

**7.6 Mud-Bitumenized** — 0.34 cubic metre.

**7.7 Wheat Straw** — 24 kg.

**7.8 Wooden Pole** — One, 100 mm dia and 3.3 m long.

### 8. RICE PADDY THATCH

**8.1 Thatch Roof Area** — 9.3 m<sup>2</sup>.

**8.2 Average Thickness** — 150 mm of thatch plus 25 mm mud plaster on top surface and 10 mm on the bottom surface.

**8.3 Rice Paddy** — 136 bundles ( each bundle is of 1 kg ).

**8.4 Bamboo** — 23 numbers ( 3.3 m long and 250 mm dia ).

**8.5 SUTLI** — 1 kg.

**8.6 Mud-Bitumenized** — 0.34 cubic metre.

**8.7 Wheat Straw** — 24 kg.

**8.8 Wooden Pole** — One, 100 mm dia and 3.3 m long.

## **9. METHODOLOGY OF MAKING THATCH FIRE RETARDANT AND WATER REPELLENT**

**9.1** A bitumen stabilized mud plaster applied on both the top and the bottom surface, 8-10 mm thick, on the thatch made of palmyrah, coconut, reeds, rice paddy. On top surface, bitumen stabilized mud plaster is applied in two stages. In the first stage, 10 mm thick mud plaster is applied and allowed to dry. In the second stage, 10 mm thick mud plaster is applied on dried mud plastered thatch and allow to dry. A *GOBRI* (one part of soil + one part of fresh *GOBAR* + cut-back) is applied on both sides of the thatch and allowed to dry. On top dried surface, a water proofing solution (1 part bitumen + 2 parts kerosene oil) is applied with brush. Finally, two coats of either a lime wash mixed with animal glue or simple *GOBRI* may be applied in order to give a better appearance. Thus, thatch prepared becomes fire retardant and water repellent.

**9.2** Addition of bitumen makes thatch rot resistant and durable.

## **10. FIRE PERFORMANCE TEST OF THATCHES**

**10.1** The specimen of treated thatch of dimension  $1\,200 \times 1\,200 \times 100$  mm prepared as described in 3.1 and mounted on the stand in such a way that slope of thatch shall be  $30^\circ$ .

**10.2 Untreated Thatch** — A specimen of untreated thatch of size  $1\,200 \times 1\,200 \times 100$  mm mounted on the same stand keeping the slope  $30^\circ$  along with treated thatch in exactly the same geometry.

**10.3 Ignition Source for Thatches** — An angle iron of size  $50 \times 50 \times 2\,400$  mm long is placed in a horizontal direction in V-shape just below the thatches (untreated and treated) at 50 mm distance. The cotton waste or absorbant cotton,  $90 \pm 1$  g, is kept and spreaded uniformly inside V-shape angle iron. Kerosene oil 400 ml is used to imbue the cotton waste by polyethylene wash bottle.

**10.4 Pilot Flame** — A steel rod of 6 mm diameter and 450 mm long is taken and at one end, about 10 g of cotton waste tied and soaked in 25 ml kerosene oil. This is ignited with the help of a match stick.

**10.5 Fire Retardant** — Ignition source is ignited with pilot flame from one end to the other and stop clock started immediately.

**10.6** Both specimen thatches (untreated and treated) are exposed to flame simultaneously. The height of the flame of ignition source is between 120 to 150 mm.

**10.7** Untreated thatch is ignited immediately and flame spreads on the top surface of thatch within 45-50 seconds and bursts into flames completely. The flame height is raised to about 2 m (The untreated thatch generally collapses within 85 to 90 seconds).

**10.8** Fire retardant thatch is also exposed for the same period, that is, 90 seconds with the same intensity of heat and flame. This ignition source is continued up to 3 minutes. It becomes incombustible if there is no ignition, no smouldering, no surface spread of flame and remains self extinguished.

## **11. DURABILITY OF FIRE RETARDANT THATCH**

**11.1** Fire retardant and water repellent thatches of reeds, palmyrah leaves, coconut leaves, and rice paddy become durable up to 8 to 10 years instead of general one year to two year life.

**11.2** Fire retardant thatches are not affected by strong winds, rains and natural weathering.

**11.3** It becomes rot resistant.

## **12. FIRE PREVENTION MEASURES FOR FIRE RETARDANT THATCH**

**12.1** Height of the thatch shall be 2.1 m from the ground at the slopping end of the thatch.

**12.2** Materials, such as, leaves, sticks, bushes, cow dung cakes, creepers, etc, shall not be kept on the fire retardant thatch.

**12.3** Thatch shall not be allowed to sag.

**12.4** Stones and brick-bats, etc, shall not be thrown on the thatch.

**12.5** If any crack or mud plaster peels off, it shall be repaired immediately.

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